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APPLICATION

FOR

UNITED STATES LETTERS PATENT

Be it known that I, Kenji Mizutani, of 834 East Dana St., Mountain View, California, 94041, a citizen of Japan, have invented new and useful improvements in:

REMOTE ACCESSIBLE PROGRAMMING

of which the following is the specification.

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REMOTE ACCESSIBLE PROGRAMMING

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Continuing Application Data

This application is a continuation-in-part of application Serial No. 09/687,271, filed on October 13, 2000, the contents of which are incorporated herein by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates generally to a system for remote scheduling of program recording and retrieval of the recorded program.

Description of the Related Art

Much work has been devoted to facilitating the selection of movies for viewers. For example, U.S. Patent 4,920,432 and U.S. Patent 5,781,734 describe systems for use in hospitals and hotels wherein a private movie distribution system is provided. A viewer selects from an internal library of movies and video games, and the selection is sent by an internal transmission line to the room where the viewer resides. Such systems however do not permit for remote viewing since the viewer must be within the private movie distribution system, and movie selection is limited to the contents of the internal library.

Another system that aims to increase the size of the movie distribution system to permit remote viewing is the so-called movie-on-demand system available over cable television networks. Exemplary on-demand systems are described in U.S. Patent 5,995,708, U.S. Patent 5,914,712, U.S. Patent 5,956,716, U.S. Patent 5,758,257, and U.S. Patent 4,506,387. These systems describe various methods for a user to communicate with a central movie distribution system and to select a movie for viewing. They also describe various methods of organizing the available movie selections, distributing selected groups of movies to different geographic clusters of viewers, and for building a movie preference profile for viewers.

Although these movie-on-demand systems do achieve a much larger movie distribution network than the private systems used in hospitals and hotels, they are still limited to specific geographic areas that they may service. Furthermore, their systems place some inherent limitations on the number of movies they may offer for selection.

U.S. Patent 5,914,712 describes a movie distribution system that uses telephone networks to distribute movies. The system is described as being limited to fiber optic telephone networks due to practical bandwidth limitations, but permits a user to telephone a central movie distribution network and a make a movie selection. The movie is then transmitted to a specialized receiving box for display on a television. This system may eventually permit unlimited remote viewing of a movie as more and more telephone networks are transferred from wire to fiber optic networks, but this transition is very costly and currently limited to selected geographic areas. Furthermore, the described system requires that a user call in and select from a recorded list of available movies, this greatly limits the number of movie choices.

Another system that uses telephone networks to transmit multimedia information is described in U.S. Patent 5,956,716. This system is intended as an information service for travelers and maintains a library of news clips, news text, and audio announcements. It is explained that the news clips and audio announcements are preferably transcribed to text format for easier distribution. Basically, the system maintains a profile of each registered user and selects various news items that may be of interest to the user. These news items are periodically downloaded to the user's computer for review. Although this system achieves remote viewing, it is limited to small news and movie clips, and does not permit the viewer to select items for viewing. Rather, pre-selected items are transmitted to the viewer's computer.

A system that aims to increase the amount of movie selection available to a consumer is described in U.S. Patent 5,909,638. It is explained that when a consumer visits a video store, it is likely that the video store may not have the movie the consumer seeks since the store has a limited amount shelf and storage space. Therefore, a system is proposed whereby a fiber optic network links multiple video stores and kiosk video vending machines to a central distribution library. A consumer makes a movie selection, and if the movie is not locally available, it is transmitted from the central distribution library to the store or kiosk. The user selects the type of media desired, such as DVD or VHS, and the received movie is recorded onto the selected media for the consumer. Although this system increases the amount of move selection, it is still limited to the number of remote sites it may service since all the receiving sites in the network, i.e. video stores and kiosks, must be linked by a proprietary fiber optic network.

Lastly, all of the above systems provide a method for selecting from a list of available movies in a standardized library, but it is sometimes desirable to select a

program that is not available in a standardized library. This is the case, for example, when one wishes to watch a televised program scheduled to air at an inconvenient time and/or location. In such a case, one may use a video cassette recorder, VCR, to record the program for later viewing, but this requires that the user be home to activate or program the VCR, and thus does not permit for remote access. U.S. Patent 5,420,913 describes a system whereby a remote user may program a VCR by telephone, but the user must still wait until he/she returns in order to watch the recorded program or have the VCR's video tape mailed to the user's remote location for viewing.

Therefore, what is needed is a system for remote viewing of televised programs that is not limited to specific geographic regions, not limited to a small sub-set of available programs, and is not limited to specialized fiber optic networks.

It is an object of the present invention to provide a system for remote recording and retrieval of televised programs without requiring that recorded items be mailed, or otherwise shipped, to a remote user.

It is a further object of the present invention that this system be compatible with exiting television and telephone network infrastructure.

Summary of the Invention

The above objects are achieved in a remote record and retrieve system that permits a mobile user quick access to broadcast programs from remote locations. A user on a local computing device connects to a remote computing device through a computer network, such as the Internet. The Internet is preferred since it permits a mobile user easy access to remote computer networks throughout the world. The remote computing device has access to a television or radio tuner, to a recording mechanism, and to a data compression and encode mechanism. The user transmits recording instructions via the Internet to the remote computing device, which then proceeds to prepare the tuner and recording mechanism according the received instructions. The program scheduled for recording is also digitized, compressed and encoded into any one of a plurality of available media formats such as MPEG1, MPEG2, AVI, etc. Preferably, the user accesses the remote computer device through a logon sequence such that the remote computer device knows the identity of the mobile user. In this case, the remote computer device adds to the recording a user ID stamp identifying the user requesting the recording and a network ID stamp identifying the network being recorded. In the case of a video recording, the ID stamps are preferably placed on a visible section of the image. In the case of a purely audio recording, such as from a radio broadcast, the ID stamped may be

inserted in a data section of the file or added as an audible, computer reproduction of user's name and recorded station. The recorded program is then transmitted via the Internet to the local user. The recorded program may be emailed to the user, or may be transferred to a user specified machine accessible via the Internet by use of the Internet file transfer protocol, FTP.

Preferably, the remote computing device is aware of differences in the media format received by its tuner and the media format used by the remote user to play the recorded program. For example, if the remote computing device is in Europe receiving television signals in PAL format, and the remote user is in North America and has a television that requires NTSC format, the remote computing device will perform any required format conversion prior to transmitting the encoded program to the local user.

In a preferred embodiment, the user transmits via the local computing device additional information to the remote computing device. For example, the user may place a limit on the size of encoded files it may receive from the remote computing device. In this case, the remote computing device will divide a large file holding the encoded, recorded program into multiple smaller files of size not larger than the user specified maximum file size. The remote computing device further generates a master sequence file specifying the order in which the multiple smaller files should be played in order to form a contiguous playing session similar to that of the larger file.

Ideally, encoded program files are deleted at the remote computing device location after the files are transmitted to the remote user. The user may schedule multiple non-concurrent programs and multiple concurrent programs for recording. In this case, the user may assign a different priority level for each program. Since the remote computing device has a limited amount of storage space, and a file is ideally not deleted until it has been successfully transmitted to the user, there exists the possibility that the storage space available at the remote computing device may be full and not able to store any additional scheduled recordings. In this case, multiple management schemes using the assigned priority levels are used for determining when one scheduled program may override another in the storage space.

The above system may be implemented in a server-client arrangement, with the server being the remote computing device and the client being the local computing device. Alternatively, the remote computing device may be a general purpose, personal computer having a tuner card and having encoding hardware/software along with appropriate interface software. In this case, it is

preferable that the tuner, encoder, network interface, and control software be incorporated into a single computer daughter board, which may be attached to the personal computer's mother board. The above system may also be embodied in a specialty consumer box for interfacing a VCR with the Internet, or may be incorporated into the functionality of a VCR, or other video recording consumer box.

Other objects and attainments together with a fuller understanding of the invention will become apparent and appreciated by referring to the following description and claims taken in conjunction with the accompanying drawings.

Brief Description of the Drawings

In the drawings wherein like reference symbols refer to like parts,

Fig. 1 illustrates a first embodiment of the present invention wherein a remote computing device is implemented as a computer server or a personal computer.

Fig. 2 is first routine used by a user on a local computing device to submit recording instructions to a remote computing device.

Fig. 3 is a diagrammatic example of a large file being divided into multiple smaller files of a given maximum size.

Fig. 4 is a second routine used by a user to play a received encoded file.

Fig. 5 is a first routine used by a remote computing device for responding to and accepting recording instructions from a user.

Fig. 6 is a second routine used by a remote computing device to determine when to initiate recording of a broadcast program and deliver an encoded program file to a user.

Fig. 7 is a second embodiment of the present invention wherein a remote computing device is implemented as a specialty consumer electronics box.

Fig. 8 is a third embodiment of the present invention wherein the remote computing device incorporates all tuning and recording mechanisms internally.

Fig. 9 is a sample implementation of the embodiment of Fig. 8 wherein tuning and recording mechanisms are incorporated into a daughter board for use in a general purpose computer.

Fig. 10 a routine implemented by a personal computer incorporating the daughter board of Fig. 9.

Fig. 11 is another routine implemented by the personal computer of Fig. 10.

Fig. 12 is an additional routine implemented by the personal computer of Fig. 10.

Fig. 13 is a pictorial illustration of a recording with a user ID, or name, stamp and network ID stamp thereon.

Fig. 14 is a second embodiment of the remote computing device of Fig. 8 showing multiple tuners each having a corresponding video capture and encode box.

Figs. 15 and 16 illustrate the use of a first memory manage format for the data store in the remote computing device of Fig. 8.

Fig. 17 is a third embodiment of the remote computing device of Fig. 8 showing multiple tuners sharing a common video capture and encode box.

Fig. 18 is a second memory management format for the data store in the remote computing device of Fig. 8.

Fig. 19 is an illustration of the present invention in use with a private network using a network address translation router to access the Internet.

Description of the Preferred Embodiments

With reference to Fig. 1, multiple users, represented as user computing devices 11 and 13, are in communication with a specialized network server 15 via the Internet 17. Of course, server 15 may optionally communicate with user computing devices 11 and 13 via any type of network, but the use of the Internet 17 is the presently preferred implementation. In the present first embodiment, users 11 and 13 are remote from each other and each has access to the Internet 17 via different networks represented as separate links 19 and 21, respectively.

Server 15 has access to the Internet 17 via link 16, and is also coupled to a plurality of recording devices 23-27 and to an optional separate archive store drum 29. Recording devices 23-27 are shown to include a tape recording mechanism and may be implemented as videocassette recorders, but other recording mechanisms and mediums, such as those associated with digital recordings, are likewise applicable to present invention. Recording devices 23-27 preferably include tuning devices for receiving televised programs 31. Televised programs 31 are symbolically illustrated as a cloud and represent all locally available broadcast programs such as available from locally aired television networks and locally available cable television networks. It is to be understood that each of recording devices 23-27 may be tuned to a different televised program along symbolic link 33, which may be an antenna, a cable line, a satellite feed, or any other known broadcast reception medium.

Recording devices 23-27 are controlled by server 15 via respective communication links 35-39. Server 15 can independently control key functions of recording devices 23-27, such as tuning, record start and stop functions, and fast forward and reverse operations. In response to instructions from users 11 and 13, server 15 will activate and tune an available recording device 23-27 to a specified televised program and commence recording. Once the televised program has been recorded, server 15 rewinds the recorded program and replays it once again. This time, the played recording is sent to server 15, which proceeds to digitize and compress the signal into any one of a plurality of available video encoding formats, such as MPEG 1, MPEG 2, AVI, etc. Of course, no such rewind and digitize step is necessary if the programs are initially recorded in a digital format, but they may still need to be converted from one encoded format to another. After the recorded televised program has been digitally encoded, the recorded televised program may be erased. The resultant video encoded data file is then transmitted via the Internet 17 to a target user, 11 or 13, defined as the user that originally issued the recording instructions. Should the target user not be available, the video encoded data file may be temporarily stored in optional archive data store drum 29. The video encoded data files stored in drum 29 are preferably given a date stamp and maintained for a predetermined period of time, during which server 15 attempts to retransmit the file to its target user 11 or 13, and the file is further available for pick up by its target user. After the elapse of the predetermined period of time, the file is deleted.

It is preferable to limit the number of copies of a televised program. Therefore, the video encoded data file is preferably deleted immediately following its delivery to its target user 11 or 13. Alternatively, delivered video encoded data files may be maintained in drum 29 for a predetermined period of time during which it may be made available to other users requesting the same televised program.

A user that receives an encoded data file from server 15 may view the recorded televised program by running an appropriate decoding program or by activating an appropriate viewing device. The received file may be stored in a separate first data store 41, or may be transferred onto a standard video recording media 43, such as video compact disk (VCD), digital versatile disk (DVD), video cassette tape, etc.

In the present embodiment, users 11 and 13 function as clients to server 15. With reference to Fig. 2, in operation, a user, or client, initiates a remote record and retrieve process by running client software 51 that brings up an interface screen

and begins the process of contacting server 15. The user then connects 53 to server 15 to open a communication channel. Server 15 may optionally require authentication information such as a user name and password before permitting access to the prospective user. This would be the case if, for example, server 15 provides its services on a subscription basis and maintains a separate account file for each registered user, or client. If a user name and password are required, it is preferred that the user's name, or other identification mark, be added to a viewable section of the recording. The posted identification is intended to emphasize the personal use of the recording.

Once a user is permitted access to server 15, the user may submit various recording instructions such as a tuning channel selection and a start and stop recording interval. Preferably, additional information identifying the recorded television network, program name and televised time would also be added to a viewable section of the recording. Additionally, the user may select among various available multimedia encoding formats such as MPEG 1, MPEG 2, AVI, etc. for each recording session, and may also submit various encoding options that affect the compression ratio of a recording. For example, in order to reduce the file size of an encoded recording of given time length, a user may select a view screen size smaller than standard as well as select a lower video resolution quality.

Optionally, the server may provide the user with a list of scheduled broadcast programs. Optionally, the server may be part of a network of remotely located servers having access to broadcast programs from various geographic locations. A user may then select a specific geographic location and be presented with a list of broadcast programs available in that location, or the user may submit a program title and be presented with a list of geographic locations, program schedules, and episode descriptions where the submitted program title is available. A user may then submit recording instructions by selecting a scheduled program from the list. In this case, the user does not need to submit tuning information or start and stop times since that information is already known to the server. The user may still be required to provided preferred settings such as encode format, resolution quality level, and so on.

As explained above in reference to Fig. 1, a user may transfer a received video encoded data file onto various types of media 43, which have differing recording capacity. For example, a CD has a typical storing capacity of about 650 megabytes and a DVD has a typical storing capacity of multiple gigabytes. Other storing media have storing capacities ranging from slightly above one megabyte, such as a standard 3.5 floppy disk, to several hundred or thousand megabytes, such

as digital recording tape. Therefore, server 15 preferably offers the user an option to submit a maximum file size for each recording session. In this case, the encoding of the total recording session is divided into multiple files of size not greater than the entered maximum size.

This operation is illustrated in Fig. 3, wherein the size of an otherwise unspliced file 52 corresponding to a complete recording session is shown to be bigger than a submitted maximum file size 54. Therefore, unspliced file 52 is subdivided into multiple smaller files 58 each having a video segment of the entire unspliced file 52. The contiguous video segments 1 through z are identified and a master sequence file 60 is generated. Master sequence file 60 specifies the sequence in which the multiple files should be played in order to maintain a viewing sequence similar to that of unspliced file 52. File segments 58 and master sequence file 60 are transmitted to a location specified by the user that submitted the recording instructions.

Therefore, during the submitting of programming instruction, shown in box 55 of Fig. 2, the user preferably submits an internet protocol, IP, address to which server 15 should transfer the encoded file, or the user may submit an email address to which the encoded files should be electronically mailed. After all information has been submitted, a user logs off and exits the client software 57.

With reference to Fig. 4, once a recorded program has been encoded and received by the user, it may be viewed by the user by running appropriate multimedia software 61 and selecting the file to be played 63. The multimedia software preferably has the ability to read master sequence file 60 and contiguously play file segments 58 in correct order. Alternatively, the file may be transferred to a portable media such as a DVD, or transferred onto videotape by means of a videocassette recorder. The user may then terminate the multimedia program 65.

Server 15 similarly follows various routines. With reference to Fig. 5, server 15 is continuously responsive to connection requests 71 from users, and responds to such a request by preferably initiating an authorization sequence for a connected user. After a user has been verified and granted entry, server 15 receives recording instruction 73 from the user along with any additional parameter data such as choice of encoding format, resolution quality, etc. This data is stored in a database 75, and once the user logs off, server 15 returns to waiting for the next user request for connection 77.

With reference to Fig. 6, in a second routine, server 15 continuously compares scheduled recording times with an internal clock to determine when a recording

session should be initiated, as shown in box 81. When the comparison shows that a recording session is imminent, a recording device is tuned to the appropriate channel and a recording session is initiated 83. Following the recording of the program, step 85 explains that the recorded program is digitally encoded, if not already recorded in a digital format, and sent through network 17 to its target recipient. At this point, step 87 returns server 15 to a state of observing the database and waiting for the next recording session.

In Fig. 1, the remote computing device controlling the remote record and retrieve operation of televised programs is illustrated as computer server 15 with access to multiple video tape recording devices 23-27. In this case, the present invention is implemented as specialized software running on a general purpose computer 15 along with specialized hardware for permitting communication between server 15 and multiple video recording devices 23-27, but other variations on the invention are likewise possible.

With reference to Fig. 7, a second embodiment of the present invention replaces server 15 with a specialized multimedia box 91 functioning as a computing device controlling a single recording device 23. All elements in Fig. 7 similar to those of Fig. 1 have similar reference numerals and are defined above. Multimedia box 91 is linked to the Internet 17 via link 16 and receives recording instructions from remote user 13 via the Internet 17 in a manner similar to that of server 15 in Fig. 1. Multimedia box 91 also implements similar functions of scheduling, recording and encoding broadcast programs in a manner similar to that of server 15 in Fig. 1.

In the present case, however, multimedia box 91 may also receive recording instructions by touchtone telephone 93 via communication link 95. In a preferred embodiment, a caller on telephone 93 would identify the call as a schedule entry session by entering a predefined key code. If the predefined key code is not submitted within a predetermined period, multimedia box 91 preferably enters a second mode of operation wherein it functions as an answering machine to record received audio messages. The received messages are stored internal to multimedia box 91 and may also be encoded for transfer to a user 13 via the Internet.

Similarly, multimedia box 91 may also include a radio tuner for recording and encoding local radio broadcasts that may be sent to user 13 over the Internet 17.

In the present embodiment, multimedia box 91 and recoding device 23 are illustrated as two separate devices, but they may of course be combined into a single

specialty device such as a video cassette recorder with internet access capability, or a device incorporating a digital recording mechanism with onboard memory, such as a hard drive.

In Figs. 1 and 7, the recoding devices 23-27 of the present invention are illustrated as using tape recording mechanisms, but as stated earlier the recording device may use a digital recording mechanism or a combination of the both.

With reference to Fig. 8 a remote record and retrieve system using a digital recording mechanism is shown. All elements in Fig. 8 similar to those of Figs. 1 and 7 have similar reference numerals and are described above. In Fig. 8, the remote computing device in charge of recording and encoding programs is illustrated as a box 97 exposing some of its key components. Box 97 may be a general purpose computer, a daughter board for use in a general purpose computer, or a specialized multimedia box. In the present embodiment, remote computing device 97 is shown to have a television tuner 101 for receiving televised programs 31 along link 33. As explained above, computing device 97 may optionally include a radio tuner for receiving and encoding locally aired radio stations. The output of TV tuner 101 is coupled to a video capture and encode box 103, which may be implemented completely in hardware, completely in software, or in a combination of hardware and software. Video capture and encode box 103 is preferably capable of encoding a captured video sequence into any of a plurality of known audio/video digital encoding formats. The encoded data from box 103 is stored in second data store 105. In the case of computing device 97 being implemented as a daughter board, second data store 105 may be removed off the daughter board and onto the general purpose computer in which the daughter board resides. In this case, second data store 105 may be implemented as a hard drive within the general purpose computer, which is accessible by the daughter board. The contents of second data store 105 are applied to network access interface 107 for access to the Internet 17 via link 16. In the present embodiment, data transfer from second data store 105 is initiated after the end of the current record and encode session. Alternatively, transfer of data from second data store 105 onto the Internet 17 may commence prior to the end of the current record and encode session and after a predetermined amount of encoded data has been buffered in second data store 105.

With reference to Fig. 9, a case in which computing device 97 is implemented as a daughter board for use in a general purpose computer 98 is shown. In this case, there is no need for a server 15, or multiple recording devices 23-27, previously shown in Fig. 1. In Fig. 9, daughter board 97 includes a network interface, television and/or radio tuner, data encoder to digitally compress a recording into

any of multiple formats (MPEG1, MPEG2, MPEG4, AVI, etc), software to control the whole procedure from the reservation to transferring of data files and software to deny access to unexpected users according to their username and password. As explained above, daughter board 97 may include a memory store for the data files, but preferably uses an existing data store, such as a hard drive, within general purpose computer 98 to store the data files.

General purpose computer 98 may be a personal computer, PC, located at a remote site. This configuration is advantages in situations where PC 98 is a home PC at the user's residence while the user is traveling, and is thus away from home. In such a situation, a user could remotely logon to home PC 98 using another general purpose computing device, shown as computer 13 in Fig. 9, enter recording instructions, and have the recording either saved within the home PC 98 for later viewing when the user returns, or have the recording sent to the user via the internet. In this embodiment, the user logs onto home PC 98 from a remote location and no special equipment is necessary. In this embodiment, it is preferred that general purpose computer 13 include specialized software recognized by daughter board 97 for interfacing with home PC 98.

In an alternate embodiment also shown in Fig. 9, a user using computer 13 to access home PC 98 via link 21 and the Internet 17 would preferably require the use of a specialized, second daughter board 14, sister to first daughter board 97. Both daughter boards 14 and 97 would include a sequence for identifying and recognizing each other before daughter board 97 permitted logon access to computer 13. In this embodiment, it is preferred that second daughter board 14 include hardware for decoding and playing the recordings made by first daughter board 97.

Alternatively, second daughter board may be replaced with an electronic identification key attachable to an external communication port of computer 13. In this case, daughter board 97 would verify the hardware electronic identification key through computer 13's external communication port prior to permitting logon access to a user of computer 13. In this manner, the remote use of daughter board 97, and its functionality, would be limited to its owner, or a limited group of users defined by its owner.

In still another embodiment, both daughter boards 14 and 97 have similar capabilities. That is, both have similar recording capabilities, and both may accept recording instructions from each other, but both must recognize each other before one permits access to the other. It is preferred that daughter board 97 have a limited number of recognized sister daughter boards (by board ID) so as restrict access to a small number of specific remote computers. In this manner, the user

wishing to remotely access daughter board 97 would be restricted to using a general computer 13 in which a specifically recognized sister board 14 resides.

Regardless of which daughter board 97 or 14 performs the recording in any of the above listed embodiments encompassed in Fig. 9, they do share a series of program routines, or processes. With reference to Fig. 10 a reservation process has daughter board 97 looping 203 until it receives an access request. Once a request is received, daughter board 97 requests the user name and password 205 of the requester. The received user name and password are verified 207, and if they are recognized, daughter board 97 proceeds to accept recording parameters 209 such as the start and stop times, tuning channel, data format, and so on. Assuming that daughter board 97 can tune to only one program at a time, upon receiving the recording parameters, daughter board 98 will then check 211 its reservation database to determine 213 if the newly received recording parameters conflict, or collide, with existing entries in the reservation database. If a collision is identified, then daughter board 97 returns 212 to step 209 and requests new recording parameters. Alternatively, the user may be given the option to override the existing entry in the database with which the new recording parameters are colliding. Once no collisions are observed, the entered recording parameters are saved 215 and the reservation entry process ends.

With reference with Fig. 11, once recording parameters have been entered, daughter board 97 enters a loop cycle 221 until its time, or close to the time, to start recording. Daughter board 97 then tunes to the appropriate broadcast (a televised show in this example, but could readily be a radio, or other type of broadcast), and begins recording 223. The recorded program is preferably saved to a data store within computer 98. The status of the recording, i.e. completion or errors, is then saved in a database file 225.

Concurrent with any of the above recited sequences, is the sequence of Fig. 12, which continuously checks the database 231 to determine if there exists a recorded file that needs to be transferred 233. If the database shows a target file that needs to be transferred (i.e. a successfully recorded broadcast that has not been picked up or previously transferred), then daughter board 97 will initiate file transfer 235 of the target file using any of a plurality of existing network transfer programs, such as the file transfer protocol FTP. The database is then updated 237 to show completion of the file transfer.

With reference to Fig. 13, a sample image 241 of a recorded televised program is shown. As stated above, the recited remote recording systems of Figs. 1, 7, 8, and 9 preferably add a visible user identifier field 245 for displaying the name or user

ID, of the person who submitted the recording instructions. User identifier field 245 is preferably posted on a lower left corner of the viewable image. It is also preferred that a visible data field 243 be displayed for posting the recorded broadcast station, recording date, recording time and/or time span, and if available, the name of the recorded televised program.

Returning to Fig. 8 and as explained above, the contents of second data store 105 may be a single file or multiple smaller files having segments of a composite recording session, and the contents of second data store 105 may be sent to a user 11 or to first data store 41. In the present example, first data store 41 is not shown isolated from the Internet 17, as was the case in the embodiment of Fig. 1. Rather, first data store 41 is shown accessible via the Internet 17 independent of user 11. This is advantageous for the cases when a user 11 is not capable of maintaining a continuous connection to the Internet 17. In this case, the user provides the IP address of first data store 41 as the target for receiving the recorded and encoded program files. First data store 41 may be, for example, another computer having a faster connection to the Internet than user 11, or may be web space leased from various commercial vendors.

With reference to Fig. 14, a multi-tuner implementation of remote computing device 97 is shown. All elements similar to those of Fig. 8 have similar reference characters and are described above. In Fig. 14, televised programs 31 are applied to a first tuner 101 and to a second tuner 102 via link 33. Both tuners 101 and 102 follow parallel paths and thus both have respective video capture and encode boxes 103/104 and respective data buffers 109/108. In the presently preferred embodiment, the parallel paths of both tuners 101 and 102 share a common second data store 105. In order to accommodate two tuners sharing a common data store, the output of first video capture and encode box 103 is applied to its corresponding first data buffer 109, and the output of second video capture and encode box 104 is applied to its corresponding second data buffer 108. The output of first video capture and encode box 103 is cached in first data buffer 109 while data from second video capture and encode box 104 is transferred from second data buffer 108 to data store 105. Similarly, the output of second video capture and encode box 104 is cached in second data buffer 108 while data from first video capture and encode box 104 is transferred from first data buffer 109 to data store 105. Once the recording session is complete, the contents of data store 105 are transferred to network access box 107 for delivery to their respective target destinations. In this manner, the video encoded files from first and second encoders 103 and 104 may be stored in

second data store 105 in alternating data blocks corresponding to first and second tuners 101 and 102.

Alternatively, data from first encoder 103 and second encoder 104 may be stored as shown in Fig. 15. In the present case, second data store 105 is divided into an upper memory space 111, a lower memory space 113, and a conflict buffer region 115 between the upper and lower memory spaces. Data from the first encoder 103 is stored in lower memory space 113 in ascending order from low memory addresses toward upper memory space 111. Conversely, data from the second encoder 104 is stored in upper memory space 111 in descending order from upper memory addresses toward lower memory space 113. Whenever either of upper memory space 111 or lower memory space 113 grows to encroach into conflict buffer region 115, a conflict signal is issued.

In the present embodiments having multiple tuners, such as those of Fig. 14 and Fig. 1, when a user issues recording instructions to a remote computing device in charge of the multiple tuners, the user preferably assigns a priority level to the programs selected for recording and thereby to their associated tuners. Additionally, if multiple users may access the remote computing device, then each user may have an associated priority level, which is applied to the user's selected program and thereby to a specific associated tuner. Thus, two levels of priority may exist. A first priority level where one user's program entries may have higher priority than another user's program entries, and a second priority level where multiple program entries by the same user are further prioritized.

In the case when one of upper memory space 111 and lower memory space 113 encroaches into conflict buffer region 115, computing device 97 resolves the priority level of the first tuner 101 and second tuner 102 and their corresponding first 103 and second 104 encoders. The encoder corresponding to the tuner of lower priority is deactivated, and the encoder corresponding to the tuner of higher priority is permitted to grow through the conflict buffer region 115 and to encroach within the memory space corresponding to the encoder of lower priority.

With reference to Fig. 16, an example is shown wherein second tuner 102 has a higher priority level than first tuner 101 and second encoder 104 is therefore permitted to grow beyond conflict buffer region 115 and encroach within the lower memory space previously assigned to first encoder 103.

With reference to Fig. 17, another embodiment of the present invention permits multiple tuners 121-123 to share a common video capture and encode box 103. All elements similar to those of Figs. 1, 7, and 8 have similar reference

characters and are described above. Multiple tuners 121 to 123 receive televised programs via link 33 and may each be tuned to a separate program, but it is to be understood that not all tuners are necessarily active at the same time. Multiple tuners are active simultaneously only when it is desirable to record multiple programs that are airing simultaneously. The output of tuners 121-123 are applied to a multiplexer 125 responsive to active tuner select bus 128. Multiplexer 125 sequentially alternates between active tuners, ignoring any inactive tuners, and transferring the signal from a currently selected active tuner to its output 126.

The output 126 of multiplexer 125 is coupled to video capture and encode box 103, which is illustratively shown to include multiple audio/video encoding format capabilities represented by boxes 131-135. It is to be understood that encoding boxes 131-135 may be implanted in hardware or software. The input to capture and encode box 103 is applied to an analog-to-digital converter 127 whose output is applied to audio/video encoders 131-135. Analog-to-digital converter 127 is of course not necessary if the output of tuners 121-123 is a digital output and not an analog output. Each of audio/video encoders 131-135 is responsive to a separate enable signal from encode format select bus 137. Only an enabled audio/video encoder 131-135 may latch in data on shared input bus 136 and may drive shared output bus 138. As was explained earlier, a user submitting recording instruction may assign a different encode format for each program to be recorded. Therefore, encode format select bus 137 activates the appropriate encoder 131-135 for each tuner 121-123 selected by multiplexer 125. The encoded output from video capture and encode box 103 is sent to second data store 105, which is applied to network access box 107 for communicating with the Internet 17.

Second data store 105 may have various configurations, such as those shown in Figs. 15 and 16. A second preferred memory configuration for second data store 105 is shown in Fig. 18. In the present example, second data store 105 includes separate memory storage units 141-147 having a one-to-one correspondence with tuners 121-123 of Fig. 17. That is, memory storage unit 1 (141) corresponds to tuner 1 (121), memory storage unit 2 (143) corresponds to tuner 2 (122), and so on up to data storage unit i (147), which corresponds to tuner i (123). Each of memory storage units 141-147 is further given a status rating and priority level mirroring its corresponding tuner. If a tuner is active, its corresponding memory storage unit is likewise assigned a status of "active". If a tuner is inactive but is scheduled for use at a later time for a recording session, its corresponding memory storage unit is assigned a status of "scheduled". If a tuner is inactive and is not scheduled for later use, its corresponding memory storage unit is assigned a status of "free".

Furthermore, any priority levels assigned to a tuner are likewise applied to the tuner's corresponding memory storage unit. If a tuner is not assigned a priority level by a user, then its priority level may be determined from its status rating. In such a case, an "active" tuner is given higher priority than a "scheduled" tuner, and a "scheduled" tuner is given a higher priority than a "free" tuner.

The assigned status and priority levels are used to reassign memory storage units 141-147 when a storage unit corresponding to an active tuner is filled to capacity prior to the end of a program being recorded. For example in Fig. 18, memory storage unit 1 (141) is "active" and has reached its capacity. Rather than deactivating its corresponding tuner 1 (121) and terminating the recording session prematurely, the status and priority level of the other data storage units 143-147 is checked to see if the recording session of tuner 1 can continue and its encoded data stored in another available storage unit. The second data storage unit 143 has a status of "active", meaning that it is currently being used by another tuner, and should not be used by tuner 1 unless no other storage unit is available and tuner 1 has a higher assigned priority level than the tuner currently using the second data storage unit 143. The third data storage unit 145 has a status label of "scheduled", meaning that it has been assigned to a different tuner for recording a scheduled program, and should not be used by tuner 1 unless there are no other data storage units of lower status and priority, and tuner 1 has a higher assigned priority level than the tuner scheduled to use third data storage unit 145. This process is continued until all the available data storage units are identified, and the lowest priority storage unit is reassigned to tuner 1. In the present case, the last storage unit 147 has a status of "free", meaning that it is not being used by any tuner and is not scheduled for use by any tuner. Therefore, tuner 1 remains active and storage of its encoded data is continued in memory storage unit 147.

All the storage units are shown to start at low memory, i.e. at the top of symbolic drums 141-147, and then proceed toward high memory, symbolized by the bottom of drums 141-147. This progression in the use of available memory is represented by arrows 149. Memory storage units that are temporarily reassigned to a different tuner than their normally corresponding tuner, may optionally begin storing data from the reassigned tuner starting at high memory at the bottom and then proceed toward low memory at the top, represented by arrow 151. In this manner, if the encoded data belonging to a temporarily assigned tuner has not been removed from the storage unit when the same storage unit begins receiving data from its normally corresponding tuner, the chances of a data writing conflict between the two tuners is lessened.

Previously it was explained that when a user submits recording instructions to the remote computing device in charge of recording and encoding a televised program, the user may submit an IP address to which the remote computing device may transmit, or push, the encoded program. The remote computing device would preferably use a standard software tool, such as the file transfer protocol, FTP, utility that is part of the suite of protocols available for the Internet. This operation functions without any difficulties if the IP address of the target machine submitted by the user corresponds to machine freely accessible from the Internet, but this may not be the case if the target machine is a within a network using a network addressing translation, NAT, utility.

A fully qualified IP address is necessary for accessing the Internet, but such fully qualified IP addresses are in short supply and increasingly becoming more expensive. Therefore, private networks typically assign nonqualified IP addresses internally to machines within the private network, and have the internal machines share a small number of fully qualified IP addresses when accessing the Internet. A router typically couples the private network to the Internet, and it may use a network address translation routine to translate a nonqualified IP address of an internal machine to a fully qualified IP address when the internal machine wishes to access the Internet.

Network address translation accomplishes this by assigning a socket number to each internal machine wishing to access the Internet, and attaching that socket number to messages that go out to the Internet using a fully qualified IP address. When a response from the Internet is received, the socket number on the returned message is matched to the internal machine that originated the Internet access. The problem is that many machines may share a fully qualified IP address, and the assigning of socket numbers is arbitrary. Furthermore, when one machine disconnects from the Internet the same socket number may be reassigned to another machine. It is therefore not possible to FTP to a specific machine behind a NAT router since the fully qualified IP address corresponds to the router and not to an internal machine behind the router.

With reference to Fig. 19, an arrangement with target user machines behind a private network 10 using network address translation is shown. All elements similar to those of Figs. 1, 7, and 8 have similar reference numerals and are described above. Router 20 and computing devices 13, 12 and 11 are part of common network 10 and linked by line 28. Computer 11 is shown coupled to network 10 through a wireless connection via access point 16, as is typical in wireless network configurations, but this is not critical to the invention. Router 20

uses a fully qualified IP address to communicate with the Internet 17 along line 19, and uses a nonqualified IP address to communicate with internal network 10 along line 28. Furthermore, each of machines 11-13 use a nonqualified IP address to communicate amongst themselves and to communicate with router 20. As explained above, router 20 implements network address translation so that computers 13, 12 and 11 all share the same fully qualified IP address when communicating with the Internet 17 via router 20, which manages traffic between the Internet and network 10.

Since a user, such as machines 11-13, wishing to communicate with remote computing device 97 cannot identify itself by IP address and its mailbox space may be insufficient for receiving a long recorded program, a user machine 11-13 may instead submit a machine name identifying one of its hard drives. A machine name typically needs to undergo a name resolution routine to identify its corresponding IP address. However, in this case, the target hard drives of the client machines 11-13 may be mounted, or shared, onto router 20 thereby creating virtual drives L1 and L2 within router 20 with links 22 and 24 to their appropriate target machines, 13 and 12. In this case, when remote computing device 97 attempts an FTP operation to a given machine name, and initiates a name resolution routine to identify the corresponding IP address, router 20 and its fully qualified IP address will be identified as corresponding to the given machine name. Router 20 will then transfer any received files to its respective virtual drives L1 and L2. As data is transferred into virtual drives L1 and L2, it is automatically transferred to the appropriate target machine 13 and 12. Thus, remote computing machine 97 manages to FTP a finished encoded file to a target user machine even if the target machine is behind a firewall consisting of a network address translation machine.

While the invention has been described in conjunction with several specific embodiments, it is evident to those skilled in the art that many further alternatives, modifications and variations will be apparent in light of the foregoing description. Thus, the invention described herein is intended to embrace all such alternatives, modifications, applications and variations as may fall within the spirit and scope of the appended claims.